

L1(5.1)-Reflecting & Stretching Quadratic Relations

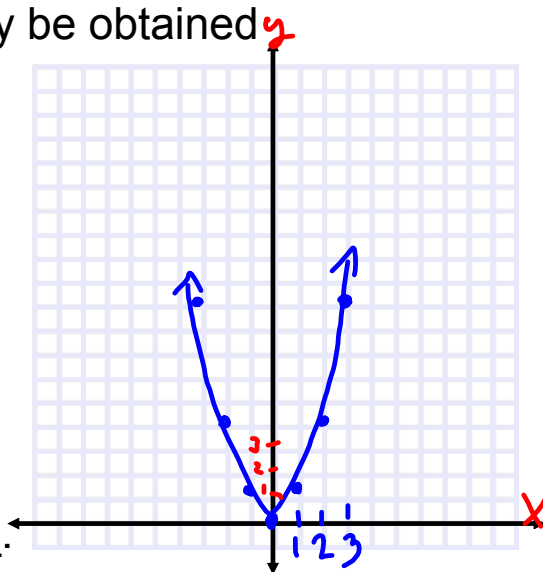
$y = x^2$  is known as the parent function for all quadratic relations. The graph may be obtained from the table of values

x	$y = x^2$
-2	4
-1	1
0	0
1	1
2	4

$$y = (-2)^2$$

Vertex

The pattern is: 1, 3, 5  
It is called the Step pattern.



Compare the graphs and TOV for  $y = x^2$ ,  $y = 2x^2$ , and  $y = \frac{1}{2}x^2$ .

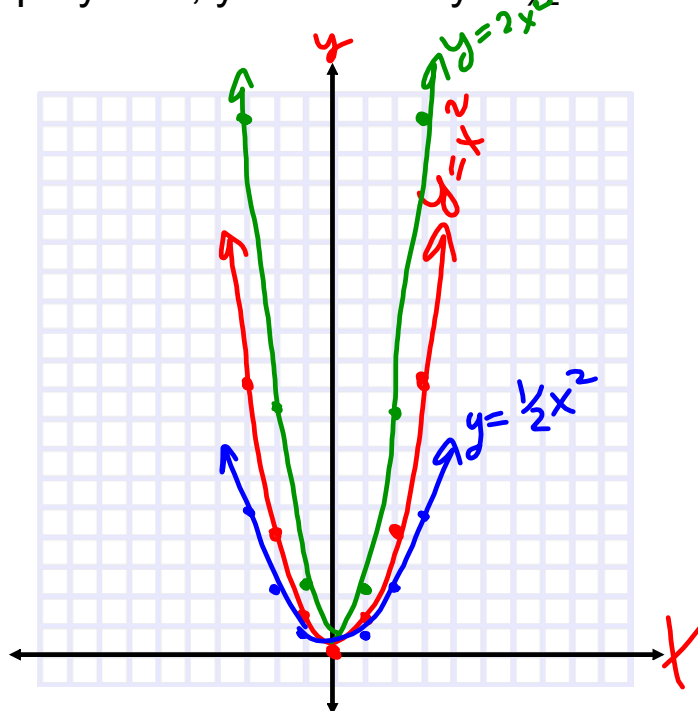
x	$y = x^2$	$y = 2x^2$	$y = \frac{1}{2}x^2$
-3	9	18	4.5
-2	4	8	2
-1	1	2	0.5
0	0	0	0
1	1	2	0.5
2	4	8	2
3	9	18	4.5

Step Patterns:	1, 3, 5	2, 6, 10	$\frac{1}{2}, \frac{3}{2}, \frac{5}{2}$	0.5, 1.5, 2.5
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What do you notice about the step pattern?

⇒ multiply a by 1, 3, 5

Graph  $y = x^2$ ,  $y = 2x^2$  and  $y = \frac{1}{2}x^2$ . ←  $0.5, 1.5, 2.5$



Recall, for  $ax^2 + bx + c$  :

$y = x^2$  ,  $a = 1$  , so  $a > 0$  , parabola opens up

$y = -x^2$  ,  $a = -1$  , so  $a < 0$  , parabola opens down. We say this parabola has been vertically reflected or reflected along the x-axis. ~~~~~

As observed from our graphs, the value of  $a$ ,  $a \neq 1$  , also changes the shape of the parabola. In general, we say that parabola ( $y = x^2$ ) has been vertically scaled.

Note: For a vertical scaling, we only care about the size, or magnitude, of 'a', so we ignore the sign. This is called the "absolute value", and has the symbol  $|a|$ .

When  $|a| > 1$ , the graph of  $y = x^2$  gets thinner. The parent function undergoes a vertical stretch.

e.g.,  $y = 2x^2$  or  $y = 4x^2$  or  $y = -2x^2$

When  $0 < |a| < 1$ , the graph of  $y = x^2$  gets wider. The parent function undergoes a vertical compression.

e.g.,  $y = 0.5x^2$  or  $y = -0.66x^2$  or  $y = -0.00005x^2$

Ex.1. Describe the transformations to  $y = x^2$  that yield the following:

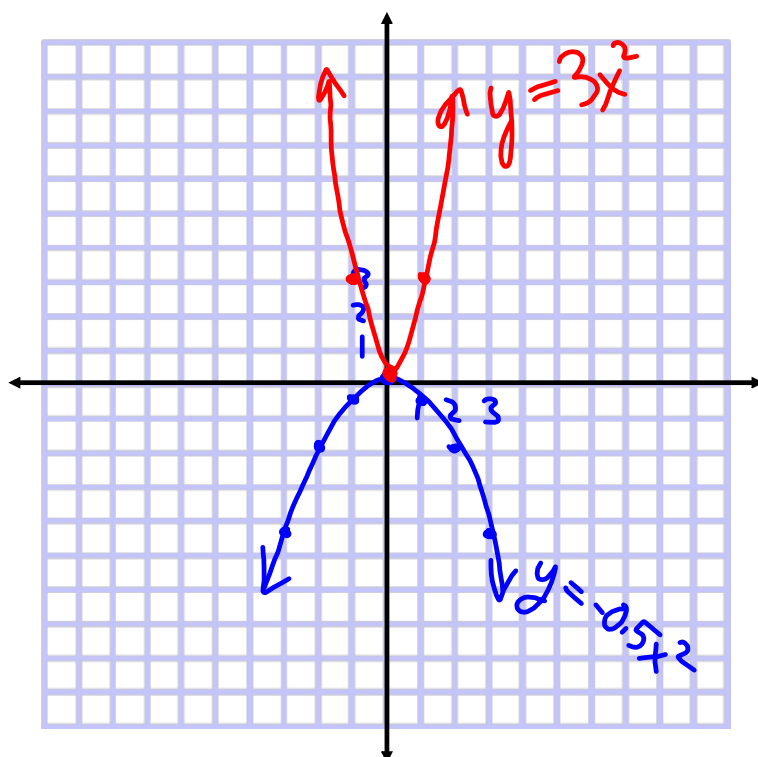
(a)  $y = \frac{1}{4}x^2$

A compression  
by a factor of  $\frac{1}{4}$   
multiply

(b)  $y = -3x^2$

reflection in the  
x axis.  
Stretch by a factor  
of 3

Ex. 2. Graph (a)  $y = -0.5x^2$  (b)  $y = 3x^2$



Assigned Work:

p. 256 # 1, 2, 4, 5, 8